



Electronic Cam Controller

EPR16/EPR48





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1 Introduction

EPR electronic cam switching devices - the intelligent solution to your control problem.

Programmed Logic Controls have asserted themselves thanks to their flexibility and efficiency. In 1982 ZANDER became one of the first companies to use microprocessor technology consistently in the realization of electronic program and cam switching devices.

Today our devices are proving themselves in almost all sectors of industry in hard daily use. EPR control systems are top-of-the-range program switching devices equipped with a 16-bit processor system. They carry out angle or distance-dependent control tasks, for example on packing machines, wood processing machines or automatic production machines.

This manual describes the EPR8, EPR16 and EPR48 units. The main differences between these variants are as follows:

- ⇒ EPR8: 8 outputs, 1 program, mechanical keyboard
- ⇒ EPR16: 16 outputs, 32 programs, splash/dust-proof sealed keyboard
- ⇒ EPR48: 48 outputs, 32 programs, modular Eurocard configuration, splash/dust-proof sealed keyboard, input for external program changeover, maximum processing power/speed

All EPR devices are operated in the same way, thus easily permitting mixed application. The explanations contained in this manual relate to all EPR variants, with reference to any differences between devices being made in the respective section.

All EPR's have connection facilities for an absolute angle/distance encoder which makes the mechanical assignment to the processing machine.

Clear text dialogue makes programming extremely simple and easy to learn by anyone within a short time. External programming devices are not required. However, Personal Computers can be used for saving data, programming and loading data into the EPR.

Easy connection with PLC, machine terminals or PCs is possible through the 48 digital switching outputs or the serial V24 interface.

Of course, the EPR48 can also be used as an autonomous control system without any other auxiliary components.

High performance correction functions such as static angle correction, selective angle correction for single outputs in ongoing operation and speed-dependent adjustment of the programmed switching sections are available for fast processing machines.

*our experience to
your advantage*

EPR variants

Variants EPR8GT, EPR16BT, EPR16GT and EPR48 provide automatic dead time correction for connected mechanical actuators in three different operating modes for individual switching outputs. The necessary angle/distance lead is calculated automatically depending on the machine speed and is updated continuously during operation.

Dead time correction

32 programs can be stored as standard within the EPR (one program in EPR8) at a resolution of one degree (360 steps per revolution). They are selected by keyboard input or, in the case of EPR48, also at digital inputs.

Programs can be copied completely or in segments.

During operation the current angle, a converted unit of length, the correction angle or the machine speed in rpm are displayed alternatively.

These data can be transferred continuously through the serial interface, e.g. to a ZANDER machine terminal or PC for standstill/speed monitoring (optional). Fully-integrated control/information systems right up to CIM processing can be realized in this way.

A watchdog output indicates fault-free operation. In addition numerous self-monitoring routines are integrated in the software so that maximum operational reliability is guaranteed.

The programming dialogue can be enabled or disabled by an optional key-operated switch connected externally.

The brightness of the display is adjustable in three stages.

Fault messages/input errors are displayed by flashing clear text.

Dialogue guidance with clear text support reduces the number of control keys required for programming all these functions to 9 in all - that means rational ergonomic design.

As an option, EPRPRO for DOS or EPRPRO for WINDOWS PC software will allow you to carry out programming with graphic support, to program the texts of EPR text display, save data, retrieve ongoing operating data, create program documentation, simulate and test dead times ask for a free demo diskette.

PC software

Problem-free industrial application under adverse ambient conditions is also guaranteed by the DIN standard 144x144 mm control panel housing with splashproof keypad on the front (not on EPR8).

If this is still not enough to meet your requirements or if extensions or modifications appear necessary for your particular application needs - just contact us. Thanks to our flexible overall concept with high capacity reserves, we will definitely be able to meet your special requirements.

1.1 Important Safety Warnings

The user manual contains all of the information that is necessary to properly install and put EPR control devices into operation. It is intended for qualified personnel familiar with the installation, commissioning or maintenance of the machine equipped with an EPR control device.

This user manual does not substitute the machine's operating instructions. This must provide separate coverage of the EPR functions used in the particular application and explain the effect these have on the machine.

Particular attention must be paid to the safety concept underlying the overall project. Supplementary safety precautions ensuring defined, safe operating statuses irrespective of the control and operating equipment must be taken in all areas where, in conjunction with automation components, faults are able to cause material damage or personal injury.

Pertinent accident prevention regulations must be observed. Emergency stop circuits to EN 60204 (VDE0133) must remain in effect in all operating modes and must not result in any undefined restart when released.

Reliable electrical isolation in the form of a transformer to VDE0551 must be provided when using 24VDC EPR control devices.

Apart from the measures described in this manual, no action must be carried out inside the device.



2 Structure

The whole unit is of modular design and is integrated in a control panel housing with DIN standard dimensions of 144x144mm.

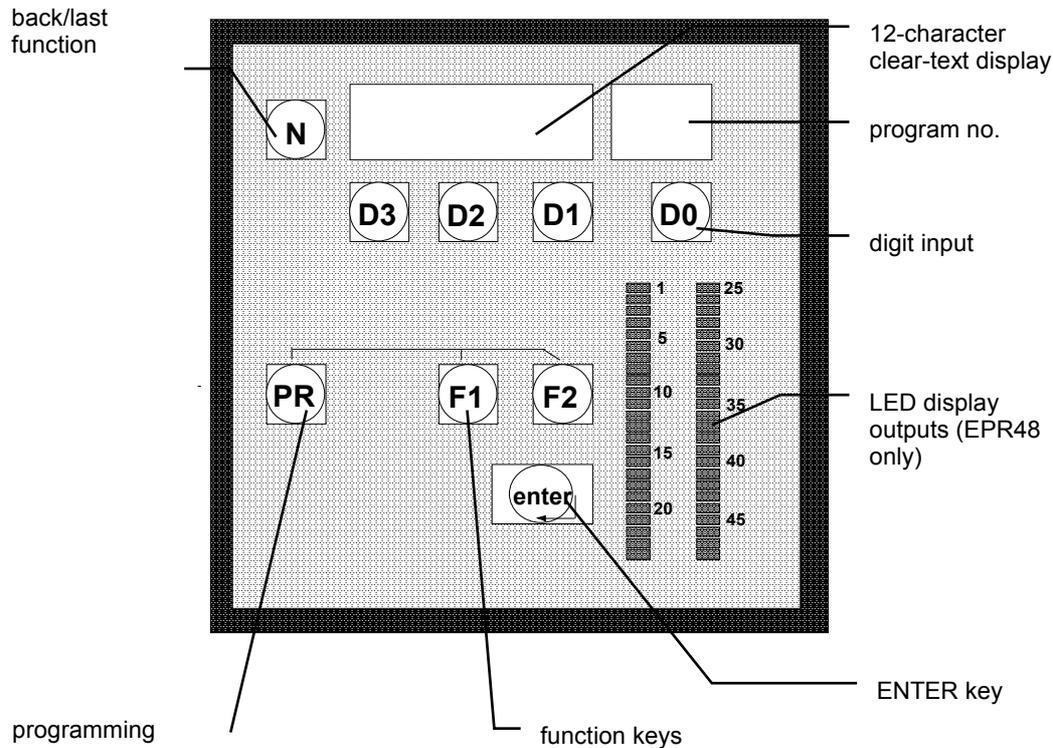


Figure 1: EPR48 front panel

EPR8/16 does not have any LED display for the outputs, the control state can be shown on the text display.

EPR8 does not have any display for the program no. or D0 key as this control unit has only one program.

2.1 EPR8/EPR16 Hardware

2.1.1 EPR8/EPR16 Output Cards

Interface cards (adapter cards) can be mounted at the rear and screw-fastened at the stud bolts provided. This affords a simple and cost-effective way of installing customer-specific output cards.

Available as standard:

for **EPR16**:

- ⇒ EPR16-RE, order no. 585450: card with 16 relay outputs 250VAC,
- ⇒ EPR16-OK, order no. 585455: card with 16 short-circuit-proof and thermally protected semiconductor outputs 0.5A, 10...30VDC.

**plug-in
output
cards**

for **EPR8**:

- ⇒ EPR8-RE, order no. 585150: card with 8 relay outputs 250VAC,
- ⇒ EPR8-OK, order no. 585155: card with 8 short-circuit-proof and thermally protected semiconductor outputs 0.5A, 10...30VDC.

The particular advantage is found in the fast and convenient manner of exchanging modules. Later customer-specific hardware alterations or extensions can be accomplished with ease. The adapter cards are simply fitted onto the OUTPUT plug of the EPR8/EPR16 and fastened to the rear panel by means of 4 screws.

2.1.2 Internal Structure of EPR8/EPR16

An internal PC board contains the power supply unit as a complete unit for supplying the whole electronics (5 V), a second independent power supply unit for supplying external encoders (12V) and the connection for the optionally usable external key-operated switch. This 12V power supply unit is electrically isolated for the units with 230VAC or 115VAC voltage supply, and electrically connected with the supply voltage for the 24VDC version. An isolating transformer must therefore be connected externally in front of units with 24VDC voltage supply.

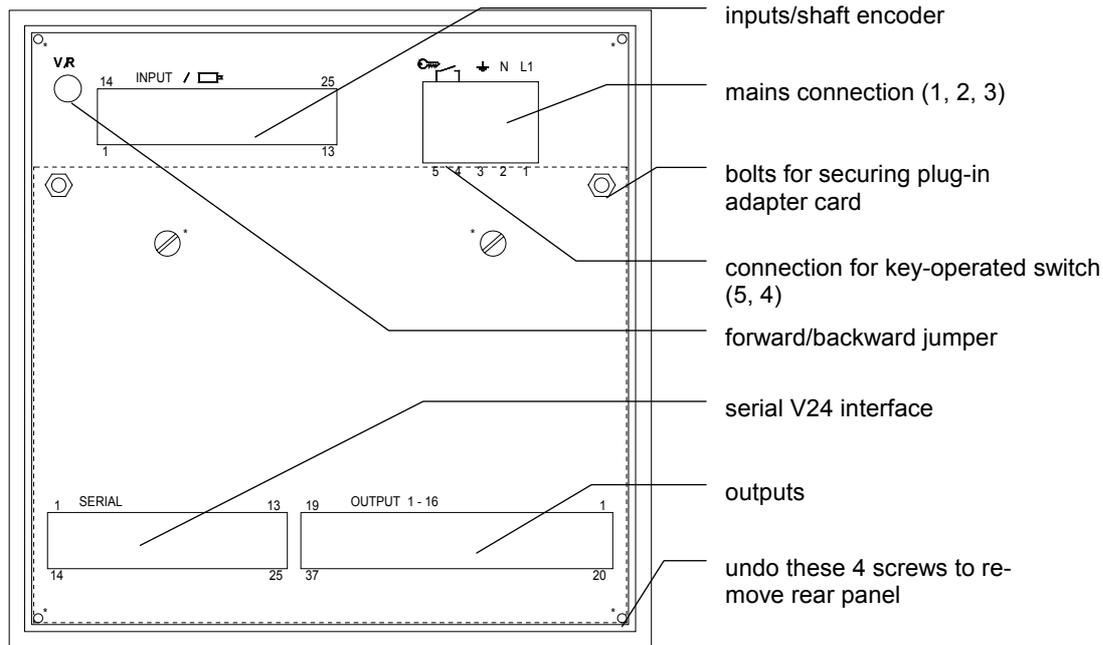


Figure 2: Rear panel of EPR8/EPR16 with connections

The key-operated switch is not integrated in the front panel in order to ensure the greatest possible protection.

An effective surge arrester and a mains filter for conditioning industrial power supplies carrying electrical interference are connected in front of the power supply unit. The EMC regulations to DIN VDE 0843 are met. A relevant certificate will be provided on request.

The power supply board also contains the lithium battery for emergency backup of the RAM (program memory). The life of the lithium battery is about 10 years under normal ambient conditions. It is therefore not usually necessary to change it.

The input circuit for the shaft encoder is provided on the same internal assembly. All inputs are electrically isolated and extremely insensitive to interference.

The microprocessor board contains a 16-bit processor, clock generator, memory, display, interrupt controller and serial interface.

The digital outputs (OUTPUT) are also located on a plug-in PC board. This board contains transistor switching outputs separated by optocouplers. The optocouplers are socket-mounted and can be exchanged with ease if necessary.

**External
key-
operated
switch**

**Lithium bat-
tery**

2.1.3 Removing the PC Boards / Mains Fuse - EPR8/EPR16

Before commencing this action inside the unit, always disconnect the mains plug - only ever open the EPR when it is in a de-energized state.

The power supply unit/input card as well as the output card are easy to remove after taking off the rear panel. To do this, undo all rear-panel screws apart from the two stud bolts (see Fig. 2). The rear panel can now be removed and you may carefully pull out the relevant card. Both cards are available separately as spare parts.

The mains fuse is located directly adjacent to the mains connection terminal. It too can be replaced with ease after removing the rear panel.

Fuses

On re-assembling, it is important to make sure that the PC boards for the power supply unit and the outputs located in the guide rails at the side are inserted properly into the plug connection on the processor board located at the bottom.

2.2 EPR48 Hardware

The whole unit is of modular design. A slide-in module system bearing the various electronic PC boards is integrated in a control panel housing with DIN standard dimensions of 144x144mm.

All the PC boards can be removed from the back without dismantling the whole housing after loosening the relevant locking screws. The major advantage is in the fast, maintenance-friendly possibility for exchanging logically related modules. Later customer-specific hardware alterations or extensions can also be accomplished in this way.

All the PC boards are available as spare parts.

2.2.1 Power Supply Unit EPR48

This PC board contains the power supply unit as a complete unit for supplying the whole electronics (5 V), a second independent power supply unit for supplying external encoders (12V) and the connection for the optionally usable external key-operated switch.

In program version V1.6 and lower the connection for the serial V24 interface SERIAL (25-pin SUB-D plug) was also provided on the power supply unit card; in version V2.0 and higher this connection is featured on the CPU card.

The key-operated switch is not integrated in the front panel in order to ensure the greatest possible protection.

An effective surge arrester and a mains filter for conditioning industrial power supplies carrying electrical interference are connected in front of the mains transformers.

The power supply board also contains the lithium battery for emergency backup of the RAM (program memory). There is a second battery directly on the processor board so that exchanging the power supply board or the lithium battery on it does not lead to data loss (double battery backup). The life of the lithium battery is about 10 years under normal ambient conditions. It is therefore not usually necessary to change it.

The whole unit is protected by primary and secondary fuses plugged to the power supply board. These may only be replaced by fuses of the same type.

Fuses

2.2.2 Inputs EPR48 (INPUT)

This module contains the input circuits for shaft encoders, external program switching and serial V24 interface.

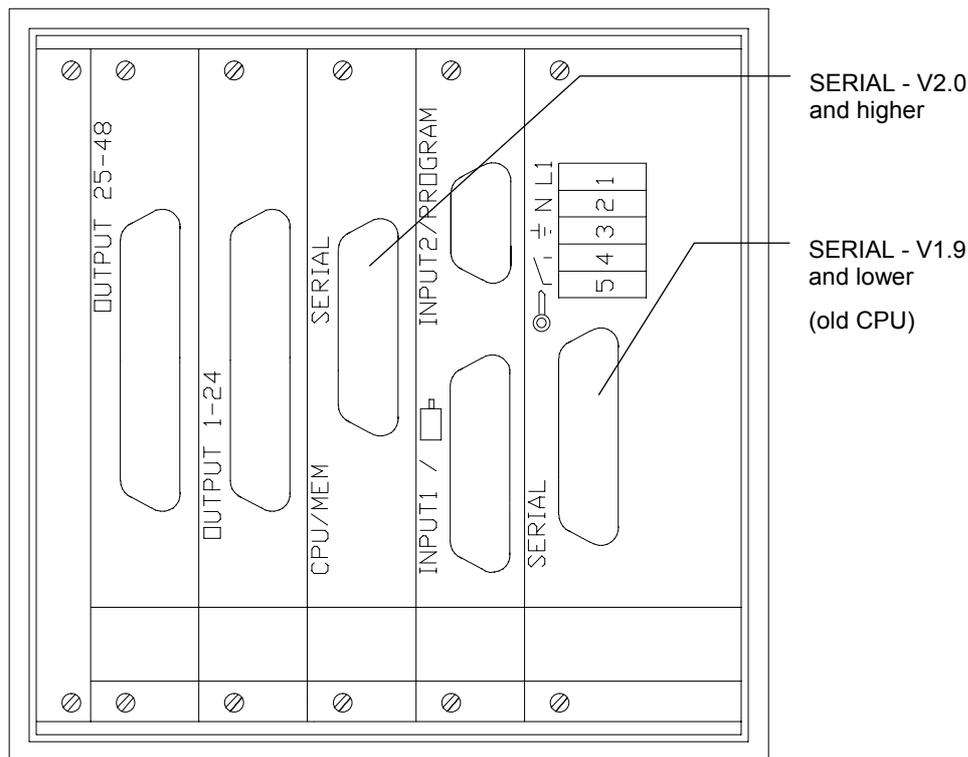


Figure 3: Rear panel of EPR48 with connections

2.2.3 CPU/MEM

Microprocessor board with 16-bit processor, clock generator, memory, interrupt controller and lithium battery. Thanks to the battery on the power supply board, removal of this PC board does not lead to a data loss in the programs, unless the memory ICs themselves are actually removed from their sockets.

Version V2.0 and higher levels feature a new, faster CPU which also contains the serial interface SERIAL (see Fig. 3)

2.2.4 Outputs

Two identical PC boards each with 24 transistor switching outputs separated by optocouplers. A plug-in bridge on the PC board determines the selection of output 1-24 or output 25-48.

The EPR48 also operates with only one of these output cards.

3 Installation

See chapter 10 for pin assignments.

3.1 Mains Connection

Check that the operating voltage and the PE conductor are connected correctly prior to initial operation.

The PE conductor connection is connected internally with the electrical shield and the mains filter. Safe earthing is therefore essential for fault-free operation.

The whole unit is protected by primary and secondary fuses plugged to the power supply board. These may only be replaced by fuses of the same type.

The inside of the housing is metal-lined and therefore well shielded against electrical interference.

Nevertheless, the following installation instructions must be observed to ensure fault-free operation:

- ⇒ Good earthing with short connection and at least 1.5 mm² cable cross section.



- ⇒ Use twisted pair, shielded cables with at least 0.25 mm² cross section for all data lines.
- ⇒ Keep a minimum distance of 40 cm away from high voltage or high frequency devices on all sides of the EPR.
- ⇒ Do not lay supply lines to the EPR together with high voltage or high frequency cables.
- ⇒ Perfect, low voltage protective earthing of the machine to be controlled.
- ⇒ All external contactors or relays equipped with anti-interference components, e.g. diodes, varistors, RC elements, etc.
- ⇒ Lay digital signal inputs with shielded cables earthed on one side.
- ⇒ Conductively connect metal housing of shaft encoder with protective earthing or mount on earthed metal flanges.

3.2 Outputs

The transistor outputs switch a maximum 60 V/100 mA. They are not permanently short-circuit-proof. A brief surge voltage up to 200V does not cause destruction. The optocoupler concerned should be replaced, however, if a defect occurs. See chapter 2 for further details.

All the outputs are passive, i.e. the desired voltage is applied externally to connections 26-36 (+U) (contacts 26-37 for EPR 48). These contacts are internally connected on the PC board.

Attention with EPR16/EPR

Contacts 17-24 and 37 are only provided for supply voltage to any adapter cards used, they must not be connected.

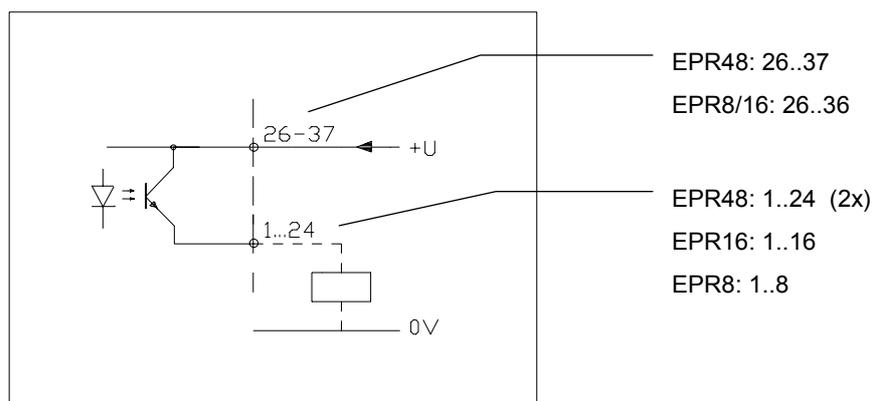


Figure 4: Transistor outputs EPR

***Exchangeable
optocoupler***



All outputs can be connected directly to the inputs of series-connected PLCs without extra components as a rule.

If the switching performance is inadequate, you may equip EPR8/EPR16 with the auxiliary relay cards or power optocoupler cards, provide ERP48 with output cards with 16 outputs at a switching capacity of 0.5A (permanently short-circuit-proof), or series-connect a ZANDER interface module adapted to load. Please ask for relevant documentation.

Production of customized output cards is possible thanks to the modular assembly.

3.2.1 Watchdog output

The watchdog output is normally switched on by the control and signals fault-free operation. The electrical data are identical with those of the other switching outputs. In EPR48 the watchdog output is only activated on output card 1-24.

3.3 Inputs

3.3.1 Shaft/Path Encoder Connection

A digital 10-bit optocoupler input serves to connect an absolute shaft encoder. EPR48, EPR16B and EPR16BT have a binary input, EPR16G, EPR16GT, EPR8G and EPR8GT a Gray-Excess76 input.

The permissible input voltage range is 10-30V.

The 12V/250mA encoder supply is available at connections 13,25 (+12V) and 1,14 (0V).

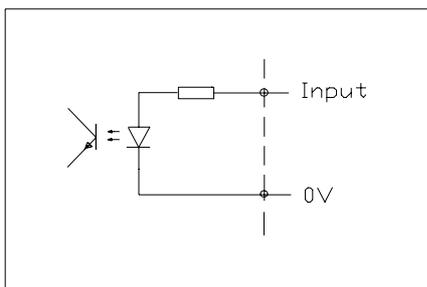


Figure 5: Optocoupler Input EPR

The shaft encoders which we offer are connector-compatible and can be connected directly without an additional voltage supply.

The direction of rotation of the encoder connected can be altered by means of a plug-in bridge:

- ⇒ On the back of EPR8/EPR16 you will find plug-in bridge "F/B" with which the direction of encoder rotation can be changed. Remove the plug-in jumper to reverse.
- ⇒ On EPR48 this plug-in bridge is marked "A" on the INPUT card. Remove the plug-in jumper to reverse.

The connection to the shaft encoder must be made with a shielded cable. We supply suitable connecting cables of the appropriate length.

Conductively connect metal housing of shaft encoder with protective earthing or mount on metal flanges to enhance interference immunity.

Refer to separate data sheet for information on our absolute shaft encoders.



**Changing
direction of
rotation**

3.3.2 Key-operated Switch

Here too, the electronics are electrically isolated by an optocoupler so that remote switching via longer connecting cables poses no problem.

The key-operated switch (to be connected to contact 4-5, see Fig. 2 and 3) enables the "Programming" function. This can be omitted completely (control unit only) or replaced by a wire bridge (programming enabled at all times), depending on your requirements.

3.3.3 External Programming (EPR48 only)

The EPR48 has a 6-bit binary input for the external selection of different programs.

Hereby there is a direct allocation between the applied binary code and the program number. The program 7 is selected for example by logic "1" (voltage) at inputs Bit0, Bit1, Bit2 and logic "0" (no voltage) at inputs Bit3, Bit4, Bit5 (decimal 7 = 000111 binary).

The new program is accepted with the positive edge of the takeover signal at connection 6 without previous selection by a dialogue function.

A program change can therefore take place without manual actuation of keys.

The switchover time to the new program is about 2s after the takeover signal.

For safety reasons a program is only accepted during standstill. Since an extremely slow machine speed below 0.1 rpm is within the scope of the measuring resolution, a program switching is also enabled in this range.

All switching outputs of the new program are switched according to the current shaft encoder setting after program change (approx. 2s after takeover signal).

3.4 Serial Interface

The bidirectional V24 interface supports the signals TxD, RxD, CTS, RTS. Compliance with all electrical regulations in accordance with S232 is guaranteed.

Connection 1 is connected with the housing and the PE conductor connection. This is switched to the shield of the data line as a rule. Lay the shield to one of the two connected devices on one side.

Use a twisted pair cable with total shielding as a data transmission cable. Here the signals RxD, TxD and RTS, CTS should be arranged respectively in twisted pairs.

***the right
cable***

The internal electronics supply voltage is applied at connection 7 (0V) and 18 (+5V).

The electrically isolated encoder supply voltage is applied between connection 9 (+12V) and 10 (0V). It can be used as an additional supply to smaller external components if necessary. In this case the total load including encoder may not exceed 250 mA. This supply voltage is also required when our V24/TTY converter is connected.

No external voltage may be applied to the voltage bearing contacts 7, 18 and 9, 10!!!

The V24 interface is not technically suitable for transmissions over distances greater than approx. 15m. The 20mA line current interface (TTY) should be used for transmissions over long distances. You can order the appropriate converter, which is integrated in the connector, from us.

RS422/485 and TTY interfaces allows transmissions over distances up to several hundred metres. All ZANDER software products are equipped with transmission checks for additional transmission error recognition and elimination.

The following parameters are preset in the software:

9600 baud, 8 bits / EVEN PARITY / 1 stop bit.

The transmission speed and the transmission delay can be set to different values in the dialogue. The same parameters must be set on the connected device.

The machine speed, the current angle and the program number can be output during operation. The data are requested by the machine terminal, PC or PLC with the telegram:

<stx>SW<cr>.

<stx>: start of text (code 02)

<cr> : end character (code 13)

The EPR16 replies after the set transmission delay (see chapter 4.1.11 - INSTALL) with:

SWppwwwnnnn<cr>

pp: program number 00..31

www: angle 000..359

nnnn: speed in rpm 0000...9999

Continuous read-out in operation leads to a reduction in the maximum possible machine speed since the serial interface is read out interrupt-controlled! The requesting device unit should therefore request this information from the EPR only when necessary or within a fixed time schedule.

Extensive data transmission is possible at standstill by way of the "PC Communication" function (chap. 4.1.10). See the program descriptions of our software products for more information on the serial interface.

data telegram



4 Programming

4.1 Programming with Internal Programming Unit

The EPR has an efficient programming unit with which you can compile even complex programs without any prior experience.

You will be guided by the clear text display. Incorrect or illogical key combinations are not accepted.

Programming the various units, from EPR8 to the EPR48, takes place in the same structure. A system change or mixed use of our electronic program switching devices therefore poses no problem for the operator.

With the integrated programming unit you can:

- ⇒ Compile new programs with new switching areas
- ⇒ Simply change existing programs

- ⇒ Display already input switching states (documentation)
- ⇒ Delete whole programs or parts thereof
- ⇒ Copy program sections or whole programs within the EPR
- ⇒ Select different programs
- ⇒ Input a speed-dependent dead time correction for individual outputs
- ⇒ Define or modify parameters such as the transmission speed of the serial interface

The EPR has an input keyboard for this purpose, the keys of which have the following functions:

⇒ **keys D0, D1, D2, D3 (numeric input)**

Every keystroke increments the digit in the clear text display. D0 changes the program number, D1 the units, D2 the tens, D3 the hundreds position of the respective number. If kept pressed down, the digit selection runs through automatically after about 0.2s.

In this way you can preset any numeric values, e.g. for a switch on point. Units, tens and hundreds can be altered independently.

The specific advantage of this keyboard input, in addition to the easy operation, is the reduction to only 4 digit keys which increases the clarity considerably.

⇒ **ENTER key (memory key)**

This key should be pressed at the end of every numeric input.

⇒ **PR key (programming)**

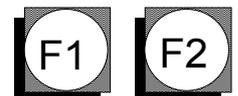
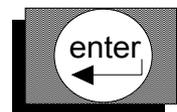
Pressing this key switches the "Programming" mode on or off respectively. Precondition for switching on the "Programming" function is that **the key-operated switch contact is closed and the machine at a standstill.**

⇒ **F1, F2 keys (select function)**

Here you can select the desired function in the "Programming" mode. Pressing F1 moves one function forwards and F2 one function backwards. The respective selected function flashes in clear text on the display, e.g. "Delete". Outside the programming mode, you can use these two keys to step between the various display functions.

⇒ **N key (correction/back)**

This key switches back one logic stage from the current input. It is used for example to select another output after switching range inputs have been made for one output.



These 9 keys in connection with the clear text display are sufficient for compiling and processing even complex programs quickly and without any problems.

4.1.1 Start and End of Programming

To start the functions for programming, close the key-operated switch (or connect the key-operated switch connections) and press the PR key.

Attention!!!

Programming is only possible with the machine at a standstill when the speed of the angle encoder is 0 !

To quit programming, press the PR key a second time. "please wait" will appear on the display (except for EPR8) while the unit is processing its internal data. When you have finished programming do not forget to remove the key from the key-operated switch in order to prevent tampering.



4.1.2 Selecting a Dialogue Function, General

Once programming has been started, the display will show you the last dialogue function to be used (in flashing clear text). You can page forwards or backwards through the various functions using keys F1 and F2. The right-hand section of the display will also indicate a 2-digit code standing for the selected function as well as the current program number (except for EPR8). All entries are only valid for the program indicated by the program number.

Press enter to activate one of the functions indicated. The following chapters describe how to operate the various functions.

Changes made to settings and numerical values will only be confirmed after pressing the enter key. The N key will allow you to undo any changes entered before pressing the enter key.

enter key

In all functions the last output number to be set will be maintained. If, for instance, you have programmed switching ranges for output 5 and then, by way of verification, you select the function to display the switching ranges, the last output 5 to be set will be displayed automatically. Keys D1 and D2 can be used to set another output.

Using the *EPRPRO for WINDOWS* PC program you can assign a text to either individual outputs or to all outputs describing, for example, the function of the output (e.g. "glue nozzle 1"). If you select an output in a dialogue function and press "enter", this output text will then appear on the display as moving text. Pressing "enter" again will resume the "normal" dialogue function. The display of output texts can be activated or deactivated in the INSTALL function.

output texts

4.1.3 New Input (Neueing.)

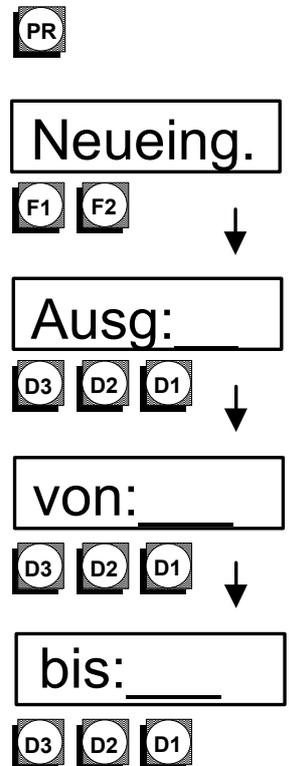
In this function the switch on values and the switch off values are determined for every output of the program concerned similarly to the setting of the cam disks in mechanical program switching devices.

The selected program is visible in the right-hand display field; e.g. display "NI 23" (NE23) means new input for program 23. The last activated program remains preset in this case.

Example:

Switching output 5 is to be switched on from angle 40 degrees to angle 160 degrees (or from path setting 40 to path setting 160 of the connected binary encoder) close the key-operated switch, if available; the "PR" key is then active

- ⇒ Press the "PR" key (programming).
- ⇒ Select the function "New inp." with the "F1" and "F2" keys.
- ⇒ Press "ENTER" if "New inp." (Neueing.) is flashing on display.
- ⇒ The display "Outp:_" (Ausg:_) appears, i.e. selection of the desired.
- ⇒ Output is expected.
- ⇒ Enter the output (e.g. 5) by repeated or continuous pressing of keys D1, D2.
- ⇒ Press "ENTER", the output is activated for entering the switching points.
- ⇒ Display "5frm_" (5von_) appears (frm = from).
- ⇒ Enter the switch on point by pressing the setting keys D1, D2, D3 (here 40 for example).
- ⇒ Press "ENTER", the switch on point is stored.
- ⇒ Display "5to_" (5bis_) appears.
- ⇒ Enter the switch off point by pressing the setting keys D1, D2, D3 (here 160 for example).



- ⇒ Press "ENTER", the switch off point is stored and the total first switching range of 40 to 160 degrees programmed at output 5.
- ⇒ Please note that the output concerned will remain activated at the programmed switch off point (the switching range extends from the switch-on point up to and including the switch-off point). The output will only be deactivated upon the next angle or path.
- ⇒ The display "5frm__" appears again. i.e. you can enter the next switch on range for output 5.
- ⇒ If you want to program the next switching output, press the "N" key (back); the display "Outp: 1" appears again.
- ⇒ Press the "N" key (back) again to quit the "New inp." function.
- ⇒ Quit the "Programming" function by pressing the "PR" key. After a short pause (display "please wait" or "bitte warten") you are back in normal mode.

All inputs are only valid for the program displayed in the program number.

A maximum of 180 switching ranges per output is possible! Ranges beyond 0 degrees can of course also be entered, for example from 255 to 4 degrees.

The clear text dialogue guide shows you at all times which input is required, logically incorrect inputs are not accepted - it couldn't be simpler!!

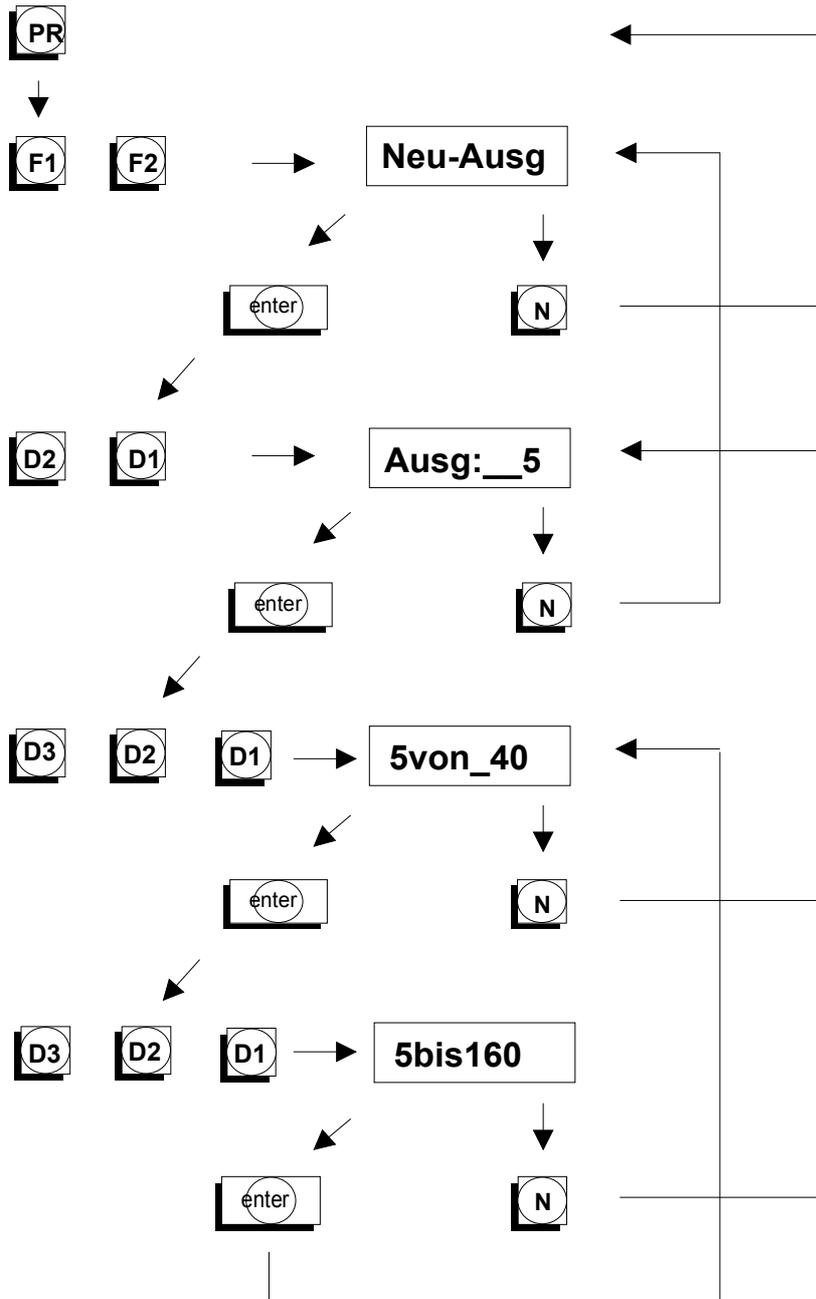


Figure 6: Keyboard Function NEW INPUT

Note: In all functions the last output number to be set will be maintained. If, for instance, you have programmed switching ranges for output 5 and then, by way of verification, you select the function to display the switching ranges, the last output 5 to be set will be displayed automatically.

4.1.4 Delete (Loeschen)

You can remove any switching ranges within the selected program with the "Delete" (Loeschen) function.

After pressing the programming key "PR" (key-operated switch must be closed!), call the "Delete" (Loeschen) function with keys "F1" and "F2"; press the "enter" key.

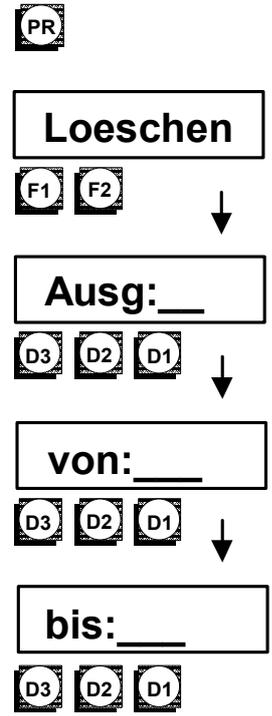
The right-hand display field displays e.g. "DE 29" (LO23)- delete within the current program 29.

Input takes place as described under "New input". First you select the output by entering the appropriate output no. and then you enter the desired range, e.g. from 23 to 235 degrees.

If you want to delete a complete output, enter delete from 1 (degree) to 0 (degree), or 0-359 degrees.

Here too, all inputs are only valid for the current program in the right-hand display field.

Quit the "Delete" function as described under "New input" by pressing the "N" key (back) or the "PR" key (back to normal mode).



4.1.5 Documentation (Dokument)

Here you can display the already programmed switching ranges in clear text after selecting an output.

Select the "Document" (Dokument) function - documentation - with the "F1" and "F2" keys in the "programming" mode.

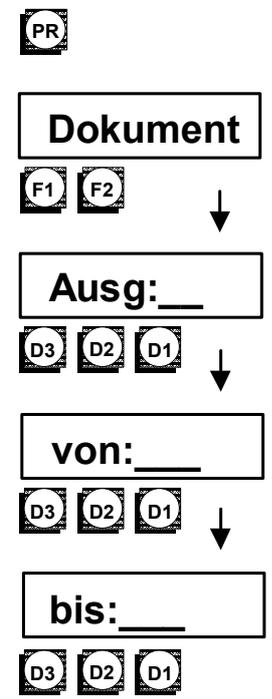
After pressing the "enter" key, the right-hand program display shows e.g. "DO 29" - documentation program 29 selected.

After entering the desired output no. the switch on and switch off points of this output are displayed every time the "enter" key is pressed.

If no switching range is programmed for the output concerned, e.g. output 5, the display will show: "5frm---" .. "5to---" (5von--- .. 5bis---).

In this way you can check your inputs without running the program and correct them with the "Delete" (Loeschen) and "New input" (Neueing.) functions described above if necessary.

Within the "Documentation" function select another output with the "N" key, back to the main menu "Programming", then press "N" again.



4.1.6 Program Selection (PR-Wahl) - (not for EPR8)

All the previous functions were related, as already mentioned, to the currently selected program.

Depending on type, an EPR can process up to a maximum of 32 programs (program nos. 0 to 31) independently without restriction.

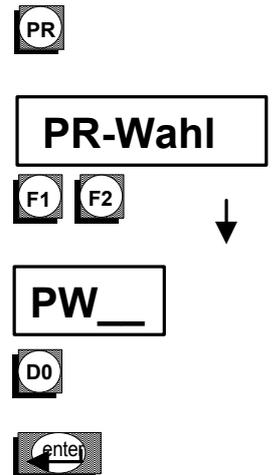
You can quit the current program and call a new program with the "Pr-selec" (PR-Wahl) - program selection function.

"PS__" (PW__) appears in the right-hand display field after calling the "Pr-selec" (PR-Wahl) function.

Then you can select another program with the "D0" key. Then press the "enter" key, the new program is set.

Press the "N" key to abort the function, and the old program will remain set.

After quitting this function and returning to the normal mode, the outputs are switched immediately according to the new program and current angle setting!



4.1.7 Copy Programs/Segments (Pr-Kopie) - (not for EPR8)

Several similar programs differing only in a few parts are frequently required.

The "Pr-copy" function (copy program) saves a lot of time here by being able to copy programmed switching ranges or complete programs at will. Program sections can be copied to any other position within the same program or into another program.

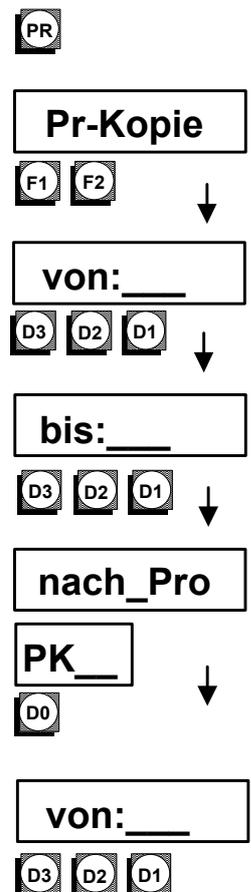
After selecting the "Pr-copy" (Pr-Kopie) function with the keys "F1", "F2" and "enter", "CO 5" (KO 5) appears for example in the program display - copy program from the current program 5.

For example, the program segment 10 degrees to 52 degrees is to be copied from program 5 to program 23, starting at angle 112 degrees:

First the known input sequence "frm__" - "to__" (von__ - bis__) with which the desired program segment is selected, i.e. from 10 to 52 degrees in this case, appears.

Then "to progr" (nach Pro) is displayed; the user is requested to enter the destination program in the right-hand input field. When the destination program, e.g. program 23, has been defined, the start value in the destination program must finally be determined. The display "frm__" (von__) appears again, with which the starting point, here 112 (degrees), is fixed.

The whole range is copied after pressing the "enter" key, the display switches back to the basic "Programming" mode.



The function can be aborted at any time by pressing the "N" key.

Note that the "Copy" function is not restricted in any way. Enter angle 0-359 to copy a complete program.

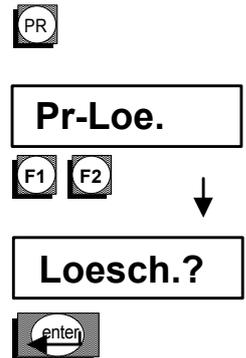
It is also possible to copy a program segment, e.g. 10-25 degrees within the same program, e.g. starting at angle 12 degrees. In this case an offset of a mere 2 degrees is the result for the selected range.

Another possibility is to compile subroutines once which can then be copied at the respective point in the current program - which simplifies the work considerably.

4.1.8 Delete Programs (Pr-Loe.)

Select the "Pr-del" (Pr-Loe) function (delete program) with the keys "F1" and "F2".

After pressing the "enter" key, the question "Delete?" (Loesch.?) appears for confirmation. If the "enter" key is then pressed, all programmed switching ranges of the current program displayed in the right-hand field are deleted; the "Pr-delete" function can be aborted without processing with the "N" key.



4.1.9 Entering Dead Times

You may select the "dead time" function using keys "F1" and "F2". Depending on the dead time mode selected, this function will enable you to define the dead times for switching an output on and for switching an output off (in dead time mode 3 only). If necessary, you should first set the desired dead time mode in the "Install" function; also see chapter 4.1.11.

The program display will show "DT 6" (TO 6) (dead time input, current program 6)

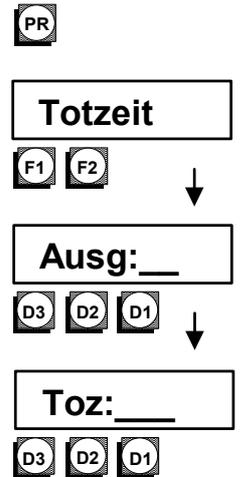
- ⇒ The display "Outp: 1" (Ausz: 1) will appear.
- ⇒ You select the desired output, e.g. 15.

Dead time mode 0, 1 or 2

In dead time mode 0, 1 or 2 you initially program the dead time for switching an output on and off.

- ⇒ The display "15Tme__0" (15Toz__0) will appear. If a dead time has already been set for the output concerned, this will be displayed.
- ⇒ Enter the (new) dead time for the output concerned with D1, D2, D3 absolutely in milliseconds. Inputs of 1 to 999 milliseconds are possible.
- ⇒ After accepting the input by pressing the "enter" key, "Outp: _1" (Ausg: _1) will reappear. You can enter the desired dead time for the next output.

A description of the various dead time modes is provided in chapter 8.3

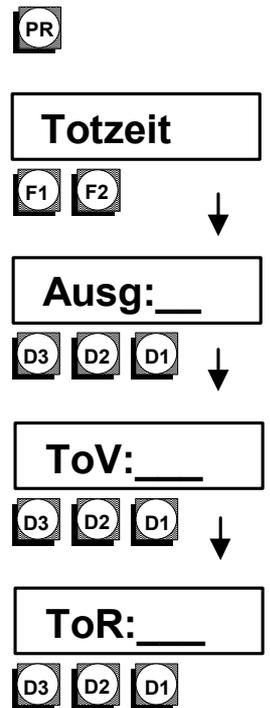


Dead time mode 3

In dead time mode 3 you initially program the dead time for switching an output on and then the dead time for switching an output off.

- ⇒ The display "15TmL__0" (15ToV__0) (L = leading edge of a switching range). If a dead time has already been set for the output concerned, this will be displayed.
- ⇒ Enter the (new) dead time for the output concerned with D1, D2, D3 absolutely in milliseconds. Inputs of 1 to 999 milliseconds are possible.
- ⇒ After confirming the input by pressing the "enter" key, "15TmeT_0" (15ToR__0) (T = trailing edge of a switching range) will appear. If a dead time has already been set for the output concerned, this will be displayed.
- ⇒ After confirming the input by pressing the "enter" key, "Outp: _1" (Ausg.: _1) will reappear. You can enter the desired dead time for the next output.

Since the dead time correction compensates the mechanical delay times of the connected actuators, the fixed dead times are automatically valid for all programs!



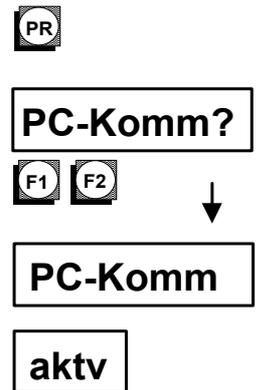
4.1.10 PC Communication (PC-Komm)

The next selection function to appear is: "PC Comm?" (PC-Komm?) - communication with Personal Computer (PC) via the serial interface SERIAL.

This function is only significant if our data transmission programs are used at the same time (see chap. 4.2).

When this function is selected the dialogue communication on the EPR48 is released by pressing "enter". Providing the right transmission speeds are available, dialogue with the PC is now possible; this is confirmed by the display "PC comm actv" (PC-Komm aktv).

This function is disabled by pressing the "N" key.



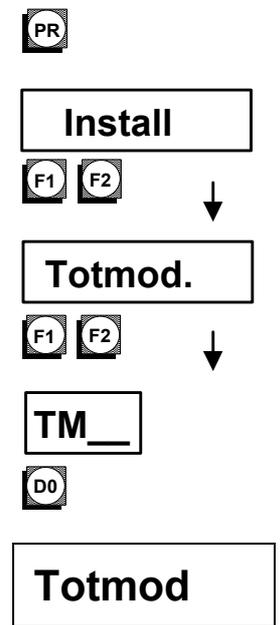
4.1.11 Installation (Install)

Various parameters can be individually adapted with this function.

After calling Installation (enter key) you can set or alter the following basic settings with the aid of the keys "F1" and "F2":

Pressing key "N" will quit a selected function or the INSTALL function in the usual way.

All the parameters determined here are retained after the power supply has been switched off.



4.1.11.1 Dead time correction mode

To do this press the "enter" key in the "Dtimemod" (Totmod.). The last setting is then displayed in the right-hand display field. Mode2 is preset. Key "D0" can be pressed to switch over to MODE3, MODE0 or MODE1. Confirm with the "enter" key.

You will find a description of the various dead time modes in chapter 8.3.

4.1.11.2 Conversion factor for the display value (also see chap. 7).

With this factor, the current angle value in the clear text display is multiplied during operation and can be displayed additionally. Select "Factor" (Faktor) with the "enter" key, whereupon the display "Fa:__.__" appears. Enter the desired conversion factor between 0.01 and 99.99 here. The factor is used for converting angle values to the corresponding units of length (m, mm, inch ..).



4.1.11.3 *Transmission speed of the serial interface:*

Select "Baudrate" (Baudrate) function, press "enter" key. The current baud rate is indicated in the right-hand display field (for EPR8 in the last 4 display digits). The value 9600 baud is preset. Select another transmission speed if necessary with the key "D0". The serial interface is set further as follows:

8 bits / EVEN PARITY / 1 stop bit.

Baudrate

4.1.11.4 *Transmission delay of the serial interface (Tr.delay):*

In addition to the baudrate a transmission delay between 0 and 990 ms can be set.

The EPR sends back a reply telegram for every received line within the scope of the telegram communication to the PC/AT/PLC. The data traffic on the serial interface can thus be checked by the connected computer. To ensure safe data communication even in slow systems, the pause until the EPR48 replies can be altered between the above mentioned values. This is particularly significant when connecting slow PCs (4.77 MHz), PLCs or self-compiled, non-speed-optimized communication software. The still supportable delay value can be determined quickly by trial, for example by transmitting data within the EPRPRO program. An AT-compatible system with 10 MHz requires a telegram delay of approx. 20 ms whereas faster PC systems operate with a delay of 0 ms without any problem.

The transmission delay is set absolutely in milliseconds. 500 ms are preset. A dialogue with all systems is normally possible with this value, although a reduction, especially in the case of data saving on floppy disk/hard disk with the aid of the EPRPRO program, is advisable as this means that the transmission time can be reduced considerably.

Sendverz

4.1.11.5 *Display of output texts (outptxt)*

You can use this function to activate or deactivate the display of output texts in various dialogue functions.

After activating the function by pressing "enter", the right-hand display window will indicate the value selected. "Y" indicates that the texts are being displayed, "N" shows that texts are not being displayed. Use the "D0" key to switch to another value; press "enter" to confirm the value that is being displayed.

Ausgtxt?

4.1.11.6 Hysteresis

This function is used to define the hysteresis range as well as the hysteresis speed to suppress the switching of outputs by vibration when a machine is idle.

After pressing "enter" to call the function, the display will show "Hyst.:_0". Using the D1 key you may enter a value between 0 and 9 degrees for the hysteresis range (the hysteresis function is not operative at 0).

Press "enter" to confirm the value selected. The display will show "Speed:_0" for the hysteresis speed. The hysteresis function is only operative at speeds below the hysteresis speed.

Also use key D1 to alter the hysteresis speed between 0 and 9 rpm, pressing "enter" to confirm the value selected (the hysteresis function is not operative at 0 rpm).

Hysteresis

4.1.11.7 Minimum rpm

This function is used for defining a minimum speed below which the outputs are switched off irrespective of angle encoder and programming (also see Chapter "Technical Details, Minimum rpm").

After pressing "enter" to call the function, the display will show "Minrpm: _0". Using the D1 key you may enter a value between 0 and 9 rpm (the function is not operative at 0 rpm). Press "enter" to confirm the value selected.

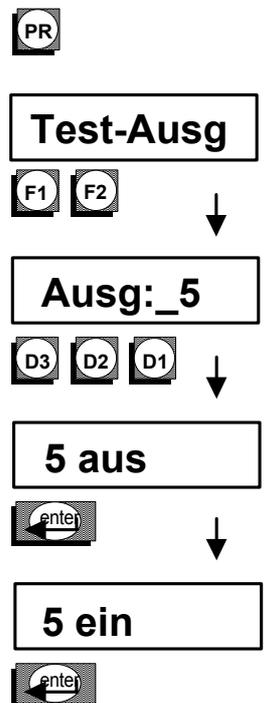
UMinimal

4.1.12 Test Mode - Outputs

The "Test outp." function allows you to switch individual outputs on and off at the press of a key. This provides a valuable aid during the set-up process since each actuator can be activated independently of the overall control system.

After calling this function, enter the desired output. This will be switched on by pressing the ENTER key and then off again by pressing ENTER a second time. This process may be repeated any number of times.

Press the "N" key to select the next output. Pressing "N" again will quit this function.



4.1.13 Version display

This function displays the unit type along with the version number of the equipment software installed, e.g. "EPR16__V2.0". This function provides no other capabilities.

4.2 Programming by Personal Computer

Since the EPR has a serial interface, it is possible to program it using an IBM-compatible PC.

ZANDER offers the highly efficient *EPRPRO* and *EPRPRO for WINDOWS* PC programs as an option. These are delivered on 3 1/2" disk.

These PC programs provide the capability of programming with graphic support, saving data, programming the EPR text display, displaying on-going process data, program documentation, dead time simulation ...

Please ask for further details.

5 Dynamic Corrections

Dynamic corrections are to be understood as the alteration of set program values during operation.

These corrections are only possible with the key-operated switch closed too!

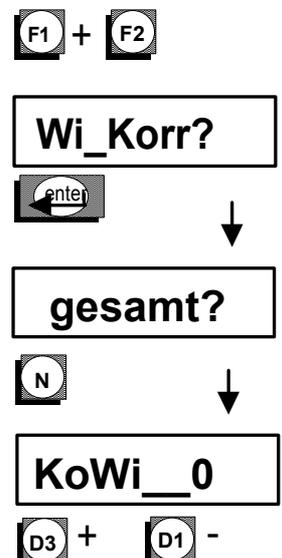
5.1 Angle Correction Whole Program

The accurate synchronization between the electrical control and the mechanical drive is a constant problem in mechanically synchronized control systems.

In the EPR therefore it is possible to input a correction angle at stand-still or during operation which shifts the whole program by a certain amount. The allocation of the switching points to each other is not affected by this.

This function saves mechanical readjustment between the shaft encoder and the drive shaft.

The correction angle is valid equally for all programs.



A correction angle is entered as follows:

- ⇒ Close the key-operated switch
- ⇒ Press the keys "F1" and "F2" simultaneously
- ⇒ The request "Ang-cor?" (Wi_Korr?) - angle correction appears as confirmation
- ⇒ If you want to abort the function at this point, press key "N" (back); otherwise press "enter" for confirmation
- ⇒ The question "whole?" (gesamt?) - correct whole program follows
- ⇒ Confirm with the "enter" key
- ⇒ The display "CoAn__0" (KoWi__0) appears, i.e. the respective current correction angle 0 (presetting) is displayed
- ⇒ Every time "D3" (+) or "D1" (-) is pressed the whole program is set forwards or backwards by one degree either during operation or at standstill. Confirmation with the "enter" key is not necessary, adjustment takes place directly by pressing "D1" or "D3".
- ⇒ Quit the correction function by pressing "N" or "PR"

For safety reasons this correction can only be done degree by degree. However, by repeated pressing of the correction keys any correction angle between 0 and 359 degrees is possible. The respective set angle (CoAn) is displayed, whereby the correction angle is always displayed positively, i.e. -2 degrees (press key D1 twice) are equivalent to a correction angle of +358 degrees.

***correction
by a degree
at a time***

5.2 Selective Angle Correction

This function is used for shifting programmed switching ranges of a selected output. This shift may apply to both the leading and trailing edges of a switching range or only to the leading edge or only to the trailing edge of a switching range. Please note that this shift affects all switching ranges of an output.

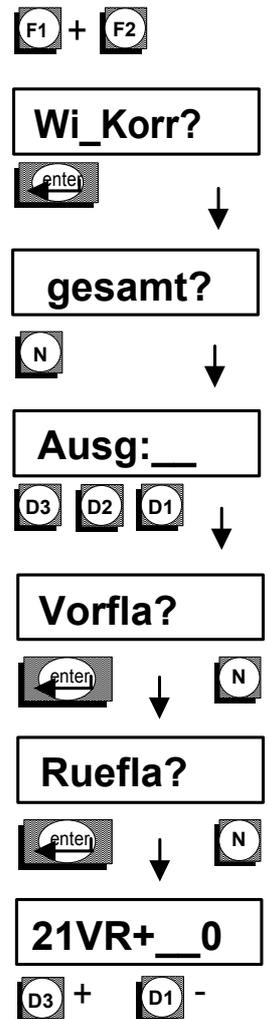
The correction remains constant after quitting the function.

It is entered as follows:

- ⇒ Close the key-operated switch
- ⇒ Press the keys "F1" and "F2" simultaneously
- ⇒ The request "Ang-cor?" (Wi-Korr?) - angle correction appears as confirmation
- ⇒ If you want to abort the function at this point, press key "N" (back); otherwise press "enter" for confirmation
- ⇒ The question "whole?" (gesamt?) - correct whole program follows
- ⇒ Press the "N" key (not whole but selective correction)
- ⇒ "Out: __" (Ausc:__) appears
- ⇒ Enter the desired output, 21 for example, confirm with the "enter" key
- ⇒ The display "Lead-ed?" (Vorfla?) - leading edge appears, adjust leading edge(s) of the programmed switching segments
- ⇒ Press "enter" if leading edge adjustment is desired, "N" if not
- ⇒ The display "Trai-ed?" (Ruefla?) appears, adjust trailing edge(s) of the programmed switching segments
- ⇒ Press "enter" if trailing edge adjustment is desired, "N" if not

If the answer to both questions is positive, the leading and trailing edge, i.e. the whole switching range of the output concerned, will be adjusted.

- ⇒ The display "21 T+ 0" (21 R+ 0) appears for example, output 21 selected, trailing edge adjustment only, previous correction 0
- ⇒ Every time "D3" (+) or "D1" (-) is pressed all leading edges and/or trailing edges of the switching range of output 21 are set forwards or backwards by one degree either during operation or at standstill. This is displayed accordingly (e. g. "21T- 5").
- ⇒ **Confirmation with the "enter" key is not necessary, adjustment takes place directly by pressing the key.**



The set correction values are only valid within the current function display. They are taken over automatically into the current switching ranges so that the setting "+0" always begins.

Quit the correction function by pressing "N" whereupon you may then enter a new output. Pressing "N" or "PR" again will return you to normal operation.

This adjustment is speed-independent unlike the dead time correction!

If only the leading or the trailing edge is adjusted, a correction is only enabled to the extent that no switching range is totally deleted or moves to an adjacent programmed range.

5.3 Dead Time Correction

This speed-dependent adjustment of individual outputs has already been described in detail in chapter 4.

Since the adjustment takes place automatically, no input is necessary during operation.

If required, however, the selective angle correction (in acc. with 5.2) can be used additionally during operation.

Observe the information provided in chapter 8.3.

6 Clear Text Display in Normal Operation

The following displays can be called during operation:

- ⇒ The current angle setting (Angle) in degrees
- ⇒ The angle multiplied by a factor (x)
- ⇒ This factor can be set between 0.01 and 99.99 in the installation program (chap. 4.1.8). The display is always an integer. Conversion has no influence on programmed switching ranges. You can therefore read off positions converted according to your machine directly, e.g. in m, cm, mm, inches, etc.
- ⇒ The machine speed in rpm
- ⇒ The correction angle CoAn (KoWi) in degrees
- ⇒ The control state of individual outputs for EPR8 and EPR16

The display is switched over by pressing the keys "F1", during operation also. The position of the key-operated switch has no significance here.

The brightness of the display can also be altered in 3 stages during operation - key "D3" (+) brighter, key "D1" (-) darker.

6.1 Display of control states for EPR8 and EPR16

In the display of output control states, keys "F1" and "F2" are used to switch between the display of outputs 1 to 8 and 9 to 16 (or 1 to 4 and 5 to 8 in the case of EPR8):

0 = output not switched

1 = output switched.

A pointer bar points to the outputs being displayed:

Character "_": Outputs 1 to 8 (or 1 to 4 in the case of EPR8).

Character "~": Outputs 9 to 16 (or 5 to 8 in the case of EPR8).

The current angle display is now visible on the right so that it can be followed in relation to the control state of the outputs.

7 Error Messages

Numerous software-controlled measures for error monitoring are standard equipment and offer added security.

In fault-free processor operation the watchdog output is activated (internal processor self-monitoring). This signal can be processed further by subsequent controls (see also chap. 3).

watchdog

Exceeding of the maximum permissible speed is detected and displayed by an asterisk " * ". In this case the functions of the EPR are retained with top priority "Switch outputs", whereby individual angle values are omitted as a result since the time for switching the outputs at every degree of the shaft encoder is no longer sufficient due to exceeding of the speed; i.e. the resolution of one degree no longer exists. The reaction time of the device to keystrokes also increases. Exceeding the speed therefore does not lead to undefined switching/function behaviour.

***exceeding
the speed***

Since speed monitoring takes place by direct angle comparison at the last processed value, orderly operation of the connected shaft encoder is checked here simultaneously.

On applying the mains voltage, a **memory test** is carried out automatically which detects errors in the stored programs with high reliability.

Such an error may occur for example when a RAM (memory component) is removed or defective. If the system detects such a table error, "Error!!!" (Fehler!!!) will flash in the display; the outputs remain switched off. All switching ranges and dead times will remain cleared and all data will be set to standard values. The "Programming" function must then be selected (PR key and key-operated switch). It is advisable to check all data ("Documentation") and correct them where necessary. The question : "Data ok??" (Daten ok??) appears at the end of the dialogue (PR key). On confirming with the "enter" key you return (with or without error correction) to the normal mode, on pressing key "N" the EPR waits with flashing display "Error!!!" (Fehler!!!) for new selection of the programming mode.

All dialogue inputs are checked for illegal or illogical values and the user is requested to repeat the input.

*memory
test*

Fehler!!!



Dokument



ev.Korrektur



Daten_ok??



8 Technical Details

8.1 Switching Ranges

"Switching range" is defined as a contiguous angle range in which an output is switched, the output being switched off in the other angle ranges. A switching range is described by a "from angle" and a "to angle". The output is switched on at the from-angle. It remains switched on up to and including the to-angle and is only switched off **after** the to-angle.

A maximum of 180 switching ranges may be defined per output if you define each switching range as exactly one degree (e.g. a "clock track").

Examples: Given a switching range of 10 - 20 degrees the output will be switched on at 10 degrees. It will still remain switched on at the 20 degree angle and will only be switched off once the 21 degree angle is reached. --With a switching range of 1-1 angle, the output will be switched on at the 1 degree angle and switched off at the 2 degree angle. This means that the output will remain switched on for the length of 1 degree.

8.2 Speed measurement

The current speed of rotation (machine speed) is calculated by counting the incoming shaft encoder pulses during a defined measurement period. The unit calculates a "direct speed" and at the same time also an "average speed".

8.2.1 Direct Speed

The period for measuring direct speed is 100 ms in a steady-state condition (relatively uniform speed). If the speed changes by at least 25 rpm, the measurement period will be reduced temporarily to 20 ms thus enabling the device to respond as quickly as possible in terms of dead time correction. If the speed change falls below 25 rpm again, the measurement period will be returned to the 100 ms measurement period in steps of 20 ms.

This "dynamic" measurement period produces a good compromise

- between a relatively accurate measurement over a long measurement period of 100 ms and
- between a rapid response by the unit to large changes in speed.

Direct speed is used for all internal functions:

- dead time correction
- hysteresis
- deactivation of outputs at speeds < minimum rpm

8.2.2 Average Speed

The period for measuring average speed is 1000 ms. This is used only for displaying the current speed.

8.3 Dead Time Correction

This is one of the most powerful and comfortable functions which the EPR has to offer.

Electromechanical actuators such as solenoid valves are usually switched through the outputs of a program switching device, partly with PLC interconnected.

The dead time of these actuators, i.e. the time between electrical excitement and mechanical reaction, poses a major problem especially on fast processing machines such as packing machines because this

reaction time leads accordingly to speed-dependent shifts.

In machines operating with constant speed this dead time can be corrected during operation by shifting the outputs accordingly.

At different machine speeds and when starting up/braking, these switching inaccuracies cannot be eliminated in this way since a speed-dependent presetting of the output triggering is now necessary.

With the aid of the "dead time correction" (Totzeit) function, it is possible to enter the mechanical dead time of the connected actuator for every output.

During operation the individual switching outputs programmed with a dead time input are preset automatically, speed-dependently and independently of each other so that the mechanical reaction on the machine corresponds exactly to the programmed angle.

The dead time input may be different for every output!!!

The shift V (in degrees of angle) of the switching points is calculated as follows:

$$V[\text{degree}] = \text{dead time}[\text{ms}] \times \text{speed}[\text{rpm}] \times 6 / 1000$$

At a dead time of 10 ms for example, and a speed of 200 rpm, the original switch-on point of 100 degrees must be shifted by 12 degrees to 88 degrees.

An additional, static, i.e. speed-independent angle correction is possible during operation even after the dead time input.

The dead time input for individual outputs does not lead to a reduction in the maximum possible machine speed but the reaction time of the dynamic presetting drops with the number of input dead times.

Caution!!!

A dead time correction always takes place towards smaller angle values, i.e. in normal mode there must be a positive direction of rotation. The direction of rotation can be reversed if required by a plug-in bridge (see chapter 3).

You can preselect 4 different dynamic reactions in the automatic dead time correction with the "INSTALL" function:

8.3.1 MODE0

No dead time correction will take place even if dead times are programmed for various outputs. This mode provides a convenient means of, for example, conducting tests without dead time correction even if you have programmed dead times for outputs (otherwise you would have to set these to 0 for such a test).



8.3.2 MODE1

During operation the individual output is preset speed-dependently according to the entered dead time, whereby the angle is preset "abruptly" to the new value in the event of a change in speed. The programmed dead time applies equally to the output's switch-on point as well as to its switch-off point (also see MODE3 for different dead times).

abrupt correction

In the case of great changes in speed in conjunction with long dead times the automatic presetting can lead to correspondingly great correction values which are activated immediately and may result in short switching segments being jumped at the time of the correction. This may lead to undefined switching behaviour. So, when using MODE1, always check whether sudden fluctuations in speed may occur which would generate an angle correction as far as a preceding switching range within a measuring interval at the defined dead times.

The advantage of this setting is the short reaction time.

8.3.3 MODE2

In the same way as MODE1, this mode uses identical dead times for switching an output on and off. The dynamic correction during operation takes place degree by degree until reaching the necessary lead. This gives a "smooth" dead time correction which ensures that no programmed switching values are jumped due to large angle corrections. The reaction time up to reaching the calculated angle offset is accordingly greater.

smooth correction

MODE2 is preset.

8.3.4 MODE3

This mode allows you to enter different dead times for the output switch-on delay and switch-off delay. Operation in MODE3 is otherwise similar to that in MODE1, i.e. dead time correction responds very quickly to changes in speed.

8.4 Hysteresis Range, Hysteresis Speed

In specific applications, switching ranges are defined directly after the idle point or directly before this idle point. If the machine is at this idle point and vibrations occur around this idle point, angle ranges may be achieved in which these outputs are activated.

Vibration

In order to suppress undesired switching processes it is possible to program a hysteresis range in conjunction with a hysteresis speed. This function is used to define the hysteresis function as well as the hysteresis speed in order to prevent vibrations from switching outputs when a machine is at a standstill.

8.5 Minimum Speed (Minimum rpm)

In order to prevent undesired switching processes when a machine is slowing down, i.e. at low shaft encoder speeds, you are able to define a minimum speed Minimum rpm.

If the current speed is less than the minimum speed, all outputs will be switched off irrespective of any switching ranges programmed. Only when the current speed reaches or exceeds the minimum speed will the outputs be switched to their programmed state.

***Switching
off outputs
at standstill***

Note: The outputs are switched off and switched back on again in relation to the directly measured speed and not the displayed average value. If the directly measured speed falls below the Minimum rpm value, it will be set internally to 0 so that dead time shifts are also cancelled internally.

9 Extensions / Special Versions

EPR-series control devices are used in a wide range of applications. This makes the adaptability of hardware/software particularly important.

To enhance the switching capacity of the output contacts, plug-in interface modules are available for the EPR8 and EPR16 units. EPR48 can be equipped with higher-capacity output cards, also see chapter 3.

The flexible, modular design enables customer-specific modification/extension requests to be realised for both hardware and software.

The EPR grows with your requirements!!

33	+U
34	+U
35	+U
36	+U
37	+U (+12V output for adapter card)

10 Conn. Pin Assignment

Outputs EPR8/EPR16 (OUTPUT)

37-pin Sub-D socket

Pin	Signal
1	output 1
2	output 2
3	output 3
4	output 4
5	output 5
6	output 6
7	output 7
8	output 8
9	(output 9)
10	(output 10)
11	(output 11)
12	(output 12)
13	(output 13)
14	(output 14)
15	(output 15)
16	(output 16)
17	0V (U2) for adapter card only
18	0V (U2) for adapter card only
19	0V (U2) for adapter card only
20	0V (U2) for adapter card only
21	0V (U2) for adapter card only
22	0V (U2) for adapter card only
23	0V (U2) for adapter card only
24	0V (U2) for adapter card only
25	watchdog
26	+U (input)
27	+U (up to 36 internally connected)
28	+U
29	+U
30	+U
31	+U
32	+U

Outputs EPR48 (OUTPUT)

37-pin Sub-D socket

Pin	Signal
1	output 1 (25)
2	output 2 (26)
3	output 3 (27)
4	output 4 (28)
5	output 5 (29)
6	output 6 (30)
7	output 7 (31)
8	output 8 (32)
9	output 9 (33)
10	output 10 (34)
11	output 11 (35)
12	output 12 (36)
13	output 13 (37)
14	output 14 (38)
15	output 15 (39)
16	output 16 (40)
17	output 17 (41)
18	output 18 (42)
19	output 19 (43)
20	output 20 (44)
21	output 21 (45)
22	output 22 (46)
23	output 23 (47)
24	output 24 (48)
25	watchdog
26	+U (input)
27	+U (up to 37 internally connected)
28	+U
29	+U
30	+U
31	+U

32 +U
 33 +U
 34 +U
 35 +U
 36 +U
 37 +U

Input Shaft Encoder (INPUT)

25-pin Sub-D socket

Pin	Signal
1	0V
2	Bit 0 (2 ⁰)
3	Bit 2
4	Bit 4
5	Bit 6
6	Bit 8
7	(Bit 10)
8	
9	
10	forward/back
11	
12	
13	+12V (output)
14	0V
15	Bit 1
16	Bit 3
17	Bit 5
18	Bit 7
19	(Bit 9)
20	(Bit 11)
21	
22	
23	
24	
25	+12 (output)

1	0V
2	Bit 0 (2 ⁰)
3	Bit 2
4	Bit 4
5	Bit 6
6	Bit 8
7	(Bit 10)
8	
9	
10	forward/back
11	
12	
13	+12V (output)
14	0V
15	Bit 1
16	Bit 3
17	Bit 5
18	Bit 7
19	(Bit 9)
20	(Bit 11)
21	
22	
23	
24	
25	+12 (output)

Connections 1 and 14 as well as 13 and 25 are internally connected.

Input program change (EPR48 only)

9-pin Sub-D socket

Pin	Signal
1	Bit 0 (2^0)
2	Bit 1
3	Bit 2
4	Bit 3
5	Bit 4
6	takeover
7	
8	0V (only if plug-in bridge "B" plugged)
9	+12V (output)

Serial Interface (SERIAL)

25-pin Sub-D plug

Pin	Signal
1	shield
2	TxD
3	RxD
4	RTS
5	CTS
6	
7	0V (GND)
8	
9	+12V (U2) encoder supply outp
10	0V (U2) " "
11	
12	
13	
14	
15	
16	
17	
18	+5V (output)
19	
20	DTR
21	
22	
23	
24	
25	

Mains connection

5-pin screw terminal

Pin	Signal
1 (L1)	220V AC or 115V AC / 24VDC *)
2 (N)	0V AC/DC
3	PE conductor
4	key-operated switch
5	key-operated switch

***) Always observe operating voltage on type plate.**

Connection cable - shaft Encoder EPR-WG

25-pin Sub-D connector

Pin	Signal	Wire colour**)
1	0V	blue
2	Bit 0 (20)	brown
3	Bit 2	black
4	Bit 4	white
5	Bit 6	violet
6	Bit 8 (28)	yellow
7		
8		
9		
10	forward/back	grey/pink
11		
12		
13	+10..24V	red
14	0V	blue
15	Bit 1	green
16	Bit 3	grey
17	Bit 5	pink
18	Bit 7	red/blue
19		
20		
21		
22		
23		
24		
25	+10..24V PE (housing)	red shield

Unused connector contacts may not be wired!

****)** colour of connection cable supplied by us

11 Technical Data

11.1.1 Installation

Operating voltage:
230VAC/115VAC/24VDC
Mains frequency AC: 50-60Hz
Residual ripple < 5%
Temperature range: 0 - +40 0C
Protection class EPR16/EPR48: IP65 on front
Protection class EPR8: IP30 on front
Installation position: any

EPR8/EPR16:

Power consumption: approx. 14VA/20W
Weight: approx. 1300g

EPR48:

Power consumption: approx. 20VA/30W
Weight: approx. 3000g

11.1.2 Angle/path encoder connection

Resolution: 10-bit binary input
electrically isolated
integr. power supply: 12VDC, 250mA
electrically isolated
Input voltage: 10-30VDC

EPR8/EPR16:

Input frequency: approx. 3500Hz max.
500 rpm at 360 steps/revolution

EPR48 (V2.0 and higher):

Input frequency: approx. 7000Hz max.
1000 rpm at 360 steps/revolution

11.1.3 Outputs

8/16/48 transistor outputs
10-60VDC, 100mA
positive switching
electrically isolated by optocouplers
37-pin SUB-D connector on rear

11.1.4 Input program change (EPR48 only)

11.1.4 Input program change (EPR48 only)

6 bit binary input, 1 takeover signal
input voltage 10-30VDC electrically iso-
lated

11.1.5 Serial interface

V24, RS232 level, 300-9600 baud
8 data bits, 1 stop bit

11.1.6 Processor system

16-bit CMOS processor system
with battery backup, zero-voltage-safe

11.1.7 Display

12-position LED dot matrix red
all ASCII characters, special characters
symbol height 5.08 mm
3 adjustable brightness levels
readable up to about 5 m
away

11.1.8 Continuous display

alternatively angle,
progr. units of length,
machine speed,
correction angle
program number
Control state of outputs

11.1.9 Self-monitoring

Watchdog with switching output
Memory check
Transmission check serial interface
Shaft encoder check for illegal data
Speed exceeded

11.1.10 Shaft encoder EPR-WG2 / EPR -WG3

EPR-WG2 gray code: Order No. 585480
EPR-WG3 binary code: Order No. 585482
Resolution: 1 degree, 0-359
Voltage: 10-24 VDC
Consumption: 200mA
Outputs: 20mA, short-circuit-proof
Protection: IP65
Temperature: 0 - 55 °C
Weight: 500p
Vibration: 100m/s² (10-10000Hz)
Connection: Plug connector IP65
Cable length: 3m, 5m, 10m (optional)

11.1.11 Accessories

EPR8-RE:

Plug-in card with 8 relay outputs
for EPR8, 3A/250V each
Order no. 585150

EPR8-OK:

Plug-in card with 8 short-circuit-
proof
transistor outputs for EPR8, 0.5A
/ 10-30VDC each
Order no. 585155

EPR16-RE:

Plug-in card with 16 relay outputs
for EPR16, 3A/250V each
Order no. 585450

EPR16-OK:

Plug-in card with 16 short-circuit-
proof
transistor outputs for EPR16, 0.5A /
10-30VDC each
Order no. 585455

EPR-OUTPUT16:

Plug-in card with 16 short-circuit-
proof
transistor outputs for EPR48, 0.5A /
10-30VDC each

PC software EPRPRO:

PC program for programming,
transmitting data, creating text,
documentation
Order no. 585712

PC software EPRPRO for Windows:

PC program for programming,
transmitting data, creating text,
documentation
Order no. 585716

Cable for serial interface

2m, 2x Sub-D socket 25-pin
Order No. 585732

Cable for serial interface

2m, 1x Sub-D socket 25-pin
1x Sub-D socket 9-pin
Order No. 585733

Shaft encoder EPR-WG2 graycode absolute

Resolution 1 degree for
EPR8(16)G(T)
Order no. 585480

Shaft encoder EPR-WG3 binary code absolute

Resolution 1 degree for
EPR48(16)(T),
EPR48
Order no. 585482

3m cable for EPR-WG2/WG3

Order no. 585494

5m cable for EPR-WG2/WG3

Order no. 585496

10m cable for EPR-WG2/WG3

Order no. 585495

Coupler WGK, 28 mm long

Order no. 585470

Angle-entry plug EPR(S)-WG

Order no. 585489

USER GUIDE EPR16/EPR48



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